



*Community Resilience
Panel Meeting
Portland, Oregon
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NIST Community Resilience Guides and Activities

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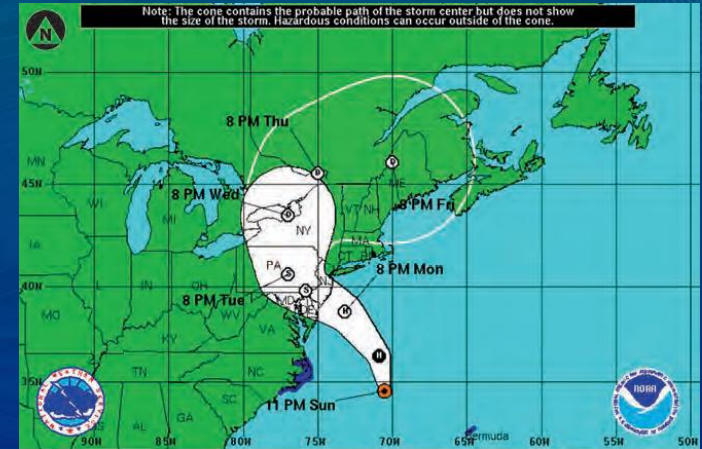
Outline

- Approach
- Community Resilience Planning Guide for Buildings and Infrastructure Systems
- Community Resilience Economic Decision Guide for Buildings and Infrastructure Systems
- Current Activities



Why Community Resilience?

- All communities face potential disruption from natural, technological, and human-caused hazards.
- Disasters take a high toll in lives, livelihoods, and quality of life that can be reduced by better managing disaster risks.
- Communities are socio-technical systems. Buildings and infrastructure enable social and economic function. Therefore, social and economic needs and functions should drive the goals for performance of buildings and physical infrastructure.
- Planning and implementing *prioritized* measures can strengthen resilience and improve a community's ability to continue or restore vital services in a more timely way – and to build back *better*.
- New tools and guidance are needed to measure resilience and plan and implement measures to enhance resilience.



What is Resilience?

- *“the ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies”.* (Presidential Policy Directive (PPD) 8)
- *“the ability to prepare for and adapt to changing conditions and to withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.”* (PPD 21)
- Resilience addresses all activities through recovery:
 - Prevention, Protection, Mitigation, Response, and Recovery
 - Risk assessments address the potential consequences of hazard's impact on existing construction and identify vulnerabilities
 - Emergency management addresses immediate response, with a focus on life safety



Community Resilience Planning Guide

- The Guide provides an organizational construct for resilience planning and implementation and could serve as an organizational approach for the Resilience Knowledge Base.
- Guidance and tools developed by the Panel or developed by others and reviewed by the Panel can be organized around the six steps in the Guide.



Planning Guide Outline

Volume 1 - Methodology

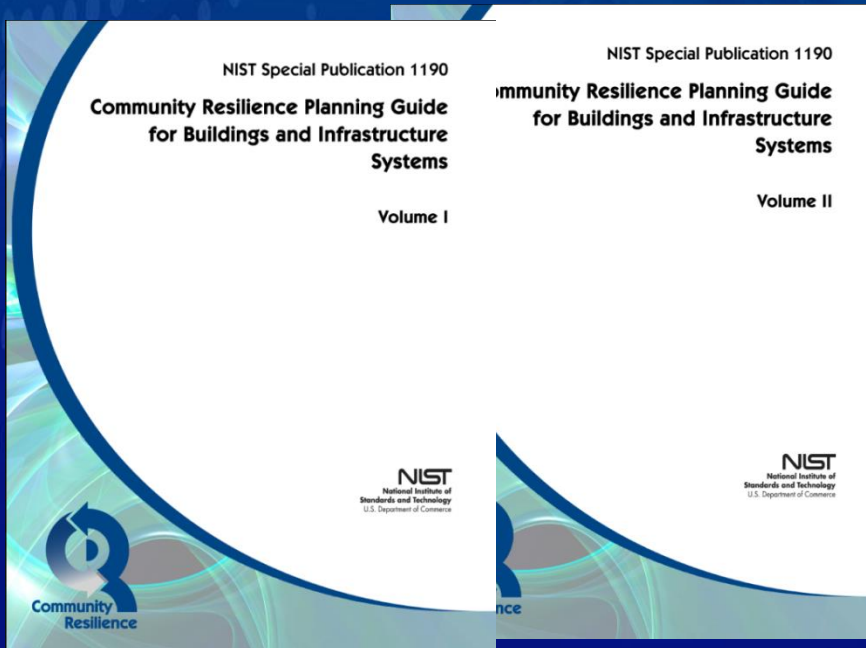
Executive Summary

- Introduction
- 6 Step Methodology
- Planning Example – Riverbend
- Glossary and Acronyms

Volume 2 - Reference

Executive Summary

- **Social** Community
- Dependencies and Cascading Effects
- **Buildings**
- **Transportation** Systems
- **Energy** Systems
- **Communications** Systems
- **Water & Wastewater** Systems
- Community Resilience Metrics

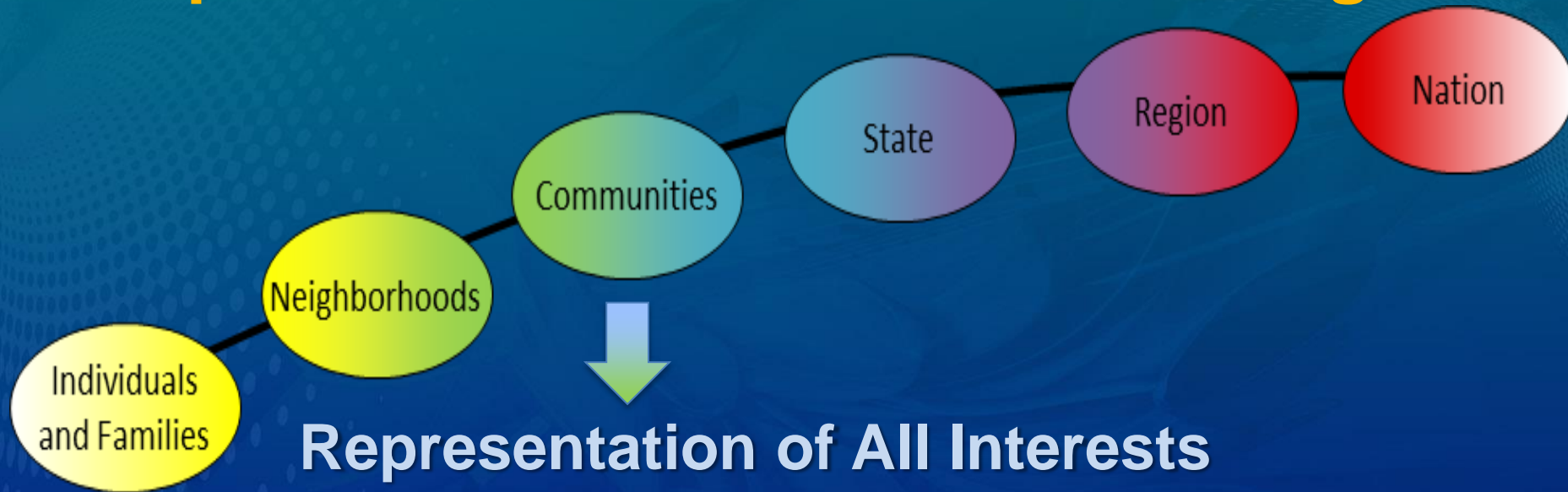


Planning Steps for Community Resilience

SIX-STEP GUIDE TO PLANNING FOR COMMUNITY RESILIENCE



Step 1. Form a Collaborative Planning Team



Public

- Elected Officials
- Local Government
- Community Members

Private

- Business and Services
 - Banking, Health care
 - Utilities
 - Media
- Organizations
 - NGOs (VOAD, Relief)



Step 2. Understand the Situation

Characterize the Social Dimensions

- **Community members**
 - Present and future needs
 - Demographics and economic indicators
 - Social Capital/Social Vulnerabilities
- **Social institutions**
 - Social functions
 - Gaps in capacity
 - Dependencies on other institutions
- **Community metrics**



Characterize the Built Environment

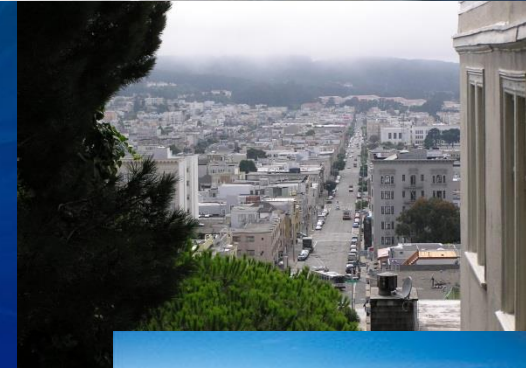
Buildings

Individual structures, including equipment and contents that house people and support social institutions



Building Clusters

A set of buildings that serve a common function such as housing, healthcare, retail, etc.



Infrastructure Systems

Physical networks and structures that support social institutions, including transportation, energy, communications, water and waste water systems.



Dependencies

Internal and External, Time, Space, Source

Characterize

Location, number, construction, demands and use, etc.



Link Social Dimensions and Built Environment

Some rely more on the built environment



Emergency Rooms



Industrial Plants

Some functions change

Schools → Shelters



Identify how services are supported

- Services provided to meet needs
- Dependency on other services and systems
- Dependency on built environment
- Consequences of loss



Step 3. Determine Goals and Objectives

Establish Long Term Community Goals

- Long term goals to improve the community can guide the prioritization and implementation process.
 - Improve reliability of infrastructure systems
 - Enhance community functions
 - Reduce travel time impacts to residents and businesses
 - Revitalize an existing blighted area
- Community resilience is achieved over time
 - Resilience can be achieved with resources for current maintenance and capital improvements



Establish Desired Performance Goals for the Built Environment

- Performance goals are independent of hazard events.
 - Community functions are needed during recovery, such as acute health care, 911 call centers, emergency response
 - Consider role of a facility or system that impacts others outside the community.
- Define goals in terms of '*time needed to restore functionality*'.
- Use goals to help prioritize repair and reconstruction efforts.
- Goals may suggest criteria for new construction and retrofit of existing construction.



Determine and Characterize Hazards

- Identify prevalent hazards
 - Wind, Earthquake, Inundation
 - Fire, Snow, Rain
 - Human-caused or Technological
- Evaluate hazards for 3 levels
 - Routine Level expected to occur frequently
 - *Should have minimal disruption*
 - Design Level used to design buildings
 - *Anchor for community planning*
 - Extreme Maximum considered possible
 - *Plan for critical services*



Anticipated Performance of Existing Built Environment

- Anticipated performance (restoration of function) during recovery depends
 - Damage level - Condition and capacity of structural and nonstructural systems
 - Recovery time - Materials, equipment, and labor needed for restoration
 - Dependencies on other systems that may be damaged



Hurricane Irene



Hurricane Katrina



Example Summary Resilience Matrix

| Infrastructure | Recovery Time | | | | | | | | |
|------------------------------|---------------|--------|----------|---------|---------|----------|-------|----------|---------|
| | Days 0 | Days 1 | Days 1-3 | Wks 1-4 | Wks 4-8 | Wks 8-12 | Mos 4 | Mos 4-24 | Mos 24+ |
| Critical Facilities | | | | | | | | | |
| Buildings | 90% | | | | | | | X | |
| Transportation | | 90% | X | | | | | | |
| Energy | | 90% | X | | | | | | |
| Water | | | 90% | | X | | | | |
| Wastewater | | | | 90% | | | | X | |
| Communication | | 90% | | X | | | | | |
| Emergency Housing | | | | | | | | | |
| Buildings | | | | | | | | | |
| Transportation | | | | | | | | | |
| Energy | | | | | | | | | |
| Water | | | | | X | | | | |
| Waste Water | | | | | | | | | |
| Communication | | | | 90% | X | | | | |
| Housing/Neighborhoods | | | | | | | | | |
| Buildings | | | | | | 90% | | | X |
| Transportation | | | 90% | X | | | | | |
| Energy | | | 90% | X | | | | | |
| Water | | | | 90% | | | | X | |
| Waste Water | | | | | 90% | | | X | |
| Communication | | | | 90% | | | X | | |
| Community Recovery | | | | | | | | | |
| Buildings | | | | | | | | 90% | X |
| Transportation | | | | 90% | X | | | | |
| Energy | | | 90% | X | | | | | |
| Water | | | | 90% | | | | X | |
| Waste Water | | | | | | | 90% | X | |
| Communication | | | | 90% | | | X | | |

Desired Performance

Anticipated Performance



Superstorm Sandy



Step 4. Plan Development

Evaluate Gaps and Identify Solutions

- **Prioritize gaps**
 - Long-term community goals
 - Social needs during recovery
 - **Identify alternative solutions**
 - Multiple stages
 - Temporary and permanent
 - Administrative
 - Construction
- **Flood plain management**
 - Reduce threat: relocate, elevate
 - **Wind and seismic preparedness**
 - Strengthen: retrofit, redundancy
 - **Recovery Plans**
 - Mutual aid agreements
 - Improvement plans

| Infrastructure | Recovery Time | | | | | | | | |
|----------------------------|---------------|--------|----------|---------|---------|----------|-------|----------|---------|
| | Days 0 | Days 1 | Days 1-3 | Wks 1-4 | Wks 4-8 | Wks 8-12 | Mos 4 | Mos 4-24 | Mos 24+ |
| Critical Facilities | | | | | | | | | |
| Buildings | 90% | | | | | | | | |
| Transportation | 90% | | | | | | | | |
| Energy | 90% | | | | | | | | |
| Water | | | 90% | | | | | | |
| Wastewater | | | | | | | | | |
| Communication | 90% | | | | | | | | |



Prioritize Solutions and Develop Implementation Strategy

- Select solutions for prioritized performance gaps
 - Determine how alternative solutions can be combined to meet community goals.
 - Consider collaborative projects.
- Develop implementation strategies
 - Quantify benefits of impact on public safety and social needs.
 - Evaluate economic impacts on community - costs and savings.
 - Consider short- and long-term benefits versus costs.
- Determine preferred implementation strategy



2013 Mandatory Soft Story Retrofit program for all older, wood-framed, multi-family buildings ensures the safety and resilience of San Francisco.



North Texas 2050 plan integrates land use, natural resources, transportation, housing, water and wastewater infrastructure, parks and open spaces.



Step 5. Plan Preparation, Review, and Approval

Plan Approval

- Document proposed implementation strategy and supporting assessments and solutions.
- Share with all stakeholders and community members
 - Public Meetings, review and comment period
- Finalize and approve community plan.



APPROVED

**Final
Community
Plan:
Implementation
Strategy**



Step 6. Plan Implementation and Maintenance

Implementation

- Formally adopt community plan to guide local government and agencies
- Identify and obtain resources to implement solutions
- Track and *communicate progress* to stakeholders

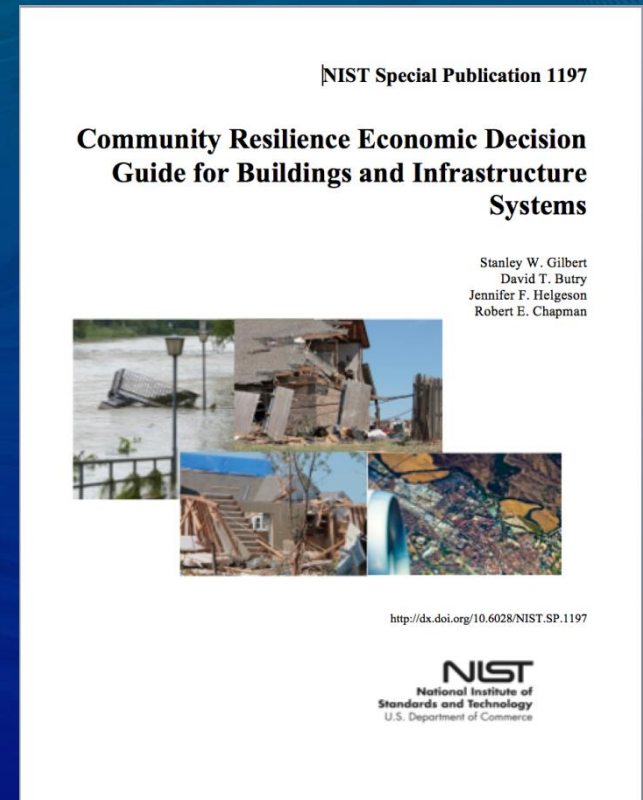
Plan Maintenance

- Review strategy and solutions on a regular basis
- Modify or update as needed

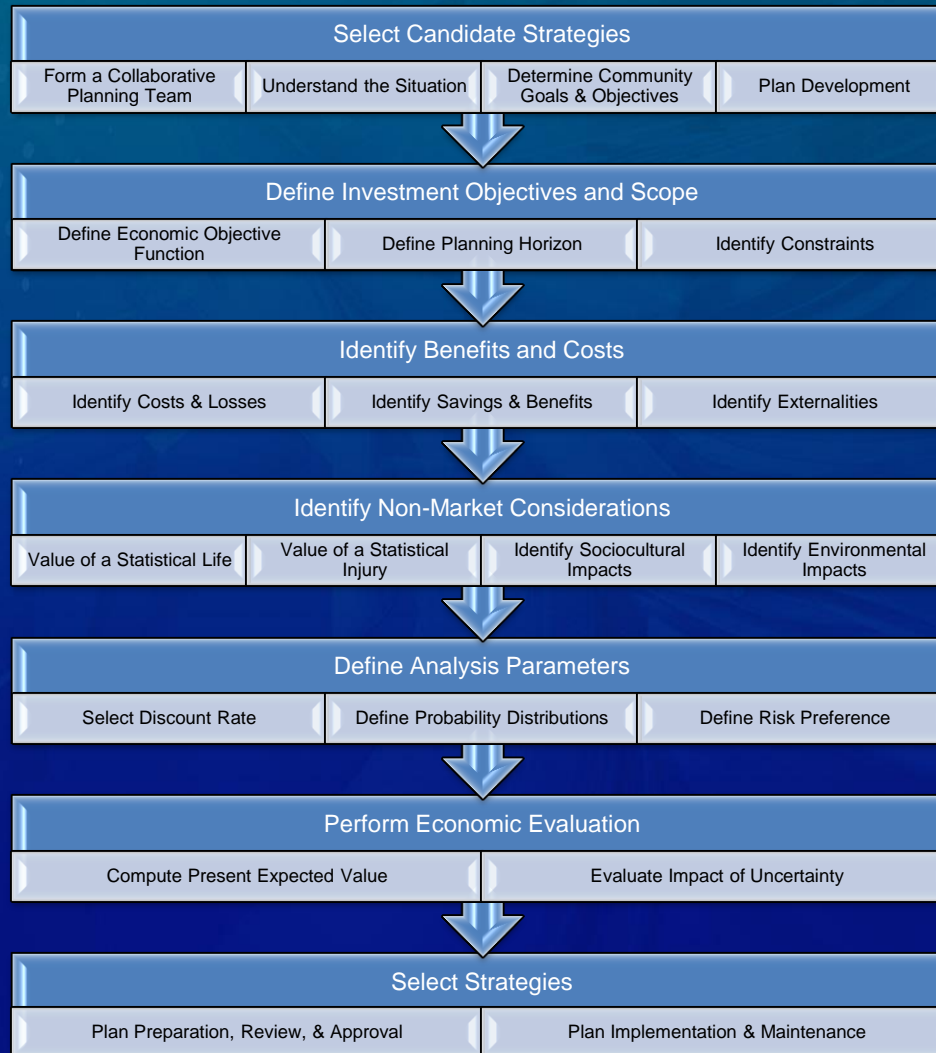


Economic Decision Guide (EDG)

- Provides a standard methodology for evaluating investment decisions aimed at improving the resilience of communities
- Specifically designed for use with NIST's *Community Resilience Planning Guide for Buildings and Infrastructure Systems*
 - Provides a mechanism to evaluate the efficiency of resilience actions and to prioritize them
- Frames the economic decision process
 - Identifies and compares resilience-related benefits & costs
 - Across competing alternatives
 - Versus the status quo (do-nothing)



EDG Process Overview

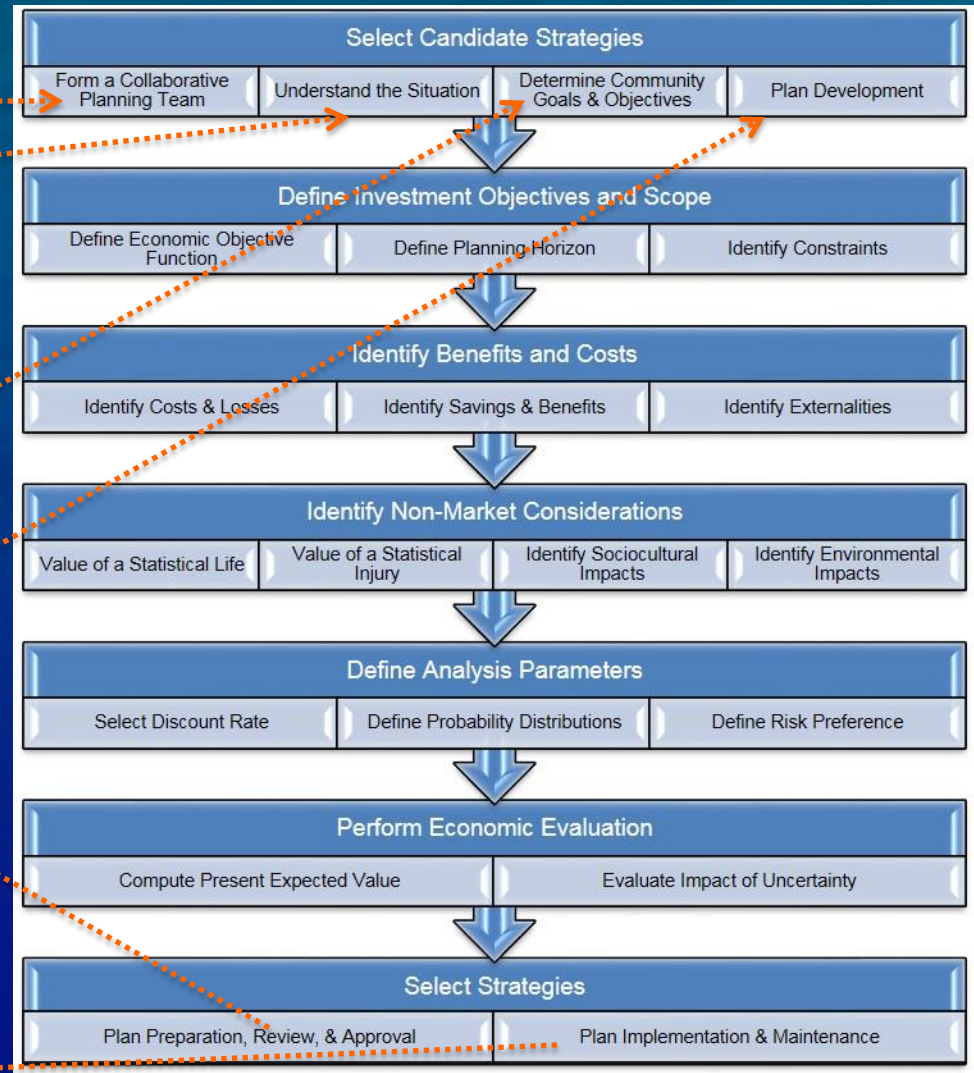


Planning Guide

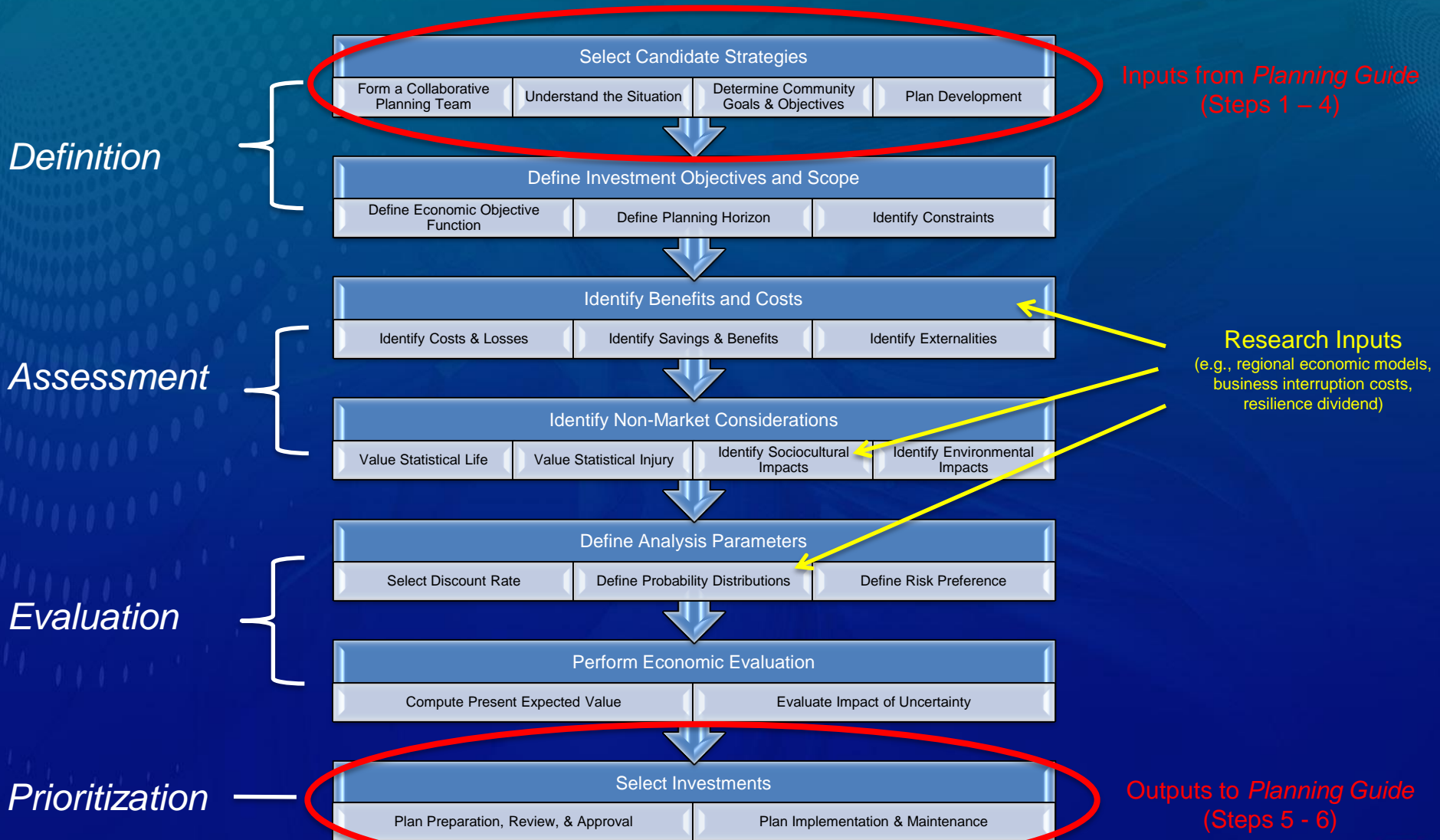
SIX-STEP GUIDE TO PLANNING FOR COMMUNITY RESILIENCE



Economic Decision Guide



Process Overview



EDG Supporting Documentation

- **Appendix A:** Community Resilience Economic Decision Example – Riverbend, USA
 - Extension of the *Planning Guide* Example
- **Appendix B:** Exposition of Model
 - Generalized description of the mathematical evaluation model
- **Appendix C:** Techniques for Loss Estimation
 - Mathematical development of loss estimation & quantification of uncertainty



Community Needs Drive Functional Requirements for the Built Environment



- Social systems drive the performance requirements for our built environment
 - Resilience levels for facilities and infrastructure systems depend on their role in the community
 - Enables a rational prioritization of available resources



Future Directions for the Economics of Community Resilience (1)

- Additional resources are needed to ensure that economic evaluations are *straightforward, transparent* and *repeatable* within a given community, across communities, and over time.
- To achieve this objective, two additional resources are needed:
 1. Industry consensus standards focused on the economics of community resilience and
 2. A user-friendly decision-support software tool based on those standards



Future Directions for the Economics of Community Resilience (2)

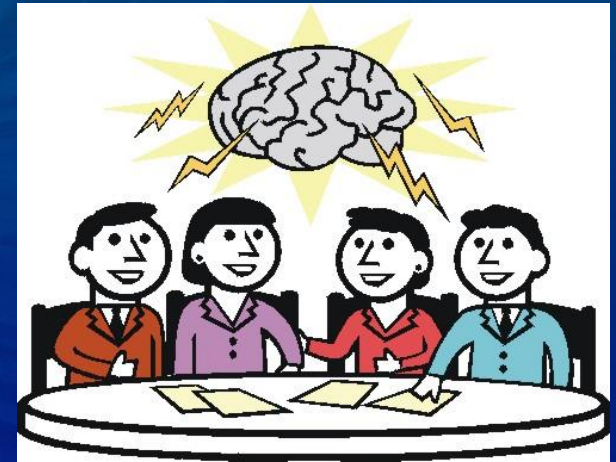
- Quantification of the Resilience Dividend
 - Many capital investments may be found to:
 1. combat chronic stressors in the community (e.g., water shortages, sea level rise) AND
 2. help plan for potential acute shocks (e.g., tornado, wildfire)
 - Benefits may be seen in community budget lines, economic diversification, greater (social and economic) opportunities for the residents even when a disruptive event has not yet occurred
- Business continuity on the establishment level
 - what makes some businesses more “resilient”?
 - looking at business interruption costs vs. direct physical losses



Next Steps ...

Use of the Guide

- Encourage use of the Guide for community resilience planning.
- Develop training tools and user forum to support implementation
- Collect data on implementation of resilience planning to inform future versions of the Guide and other products.
- Develop use-cases to document experience with use of the Guide and demonstrate how the Guide can be applied.
- Develop Resilience Planning Guide Briefs to support Guide use



Community Resilience Center of Excellence



- Awarded to 10 institution team led by Colorado State University.
- \$4M/year program funded through a cooperative agreement.
- Objectives are to:
 - Develop an integrated, multi-scale, computational modeling environment to accelerate development of systems-level models to enable new standards and tools for enhancing Community Resilience
 - Foster the development of data architectures and data management tools to enable resilience planners, code and standards professionals, engineering design experts, and researchers.
 - Conduct studies to validate models, data architectures, and data management tools for a variety of hazard events including:
 - Tornado, hurricane, earthquake, flood, Wildland-Urban Interface (WUI)
 - Effects of climate change, and effects of aging infrastructure



Community Resilience Center of Excellence

- The Center of Excellence will host a *Supporting Community Resilience* webinar April 28, 2016 from 9:00 am -12:00 pm MDT.
- Registration link:
http://resilience.colostate.edu/webinar_registration.php



NIST Contact

Website:

<http://www.nist.gov/el/resilience/>

Guide:

<http://www.nist.gov/el/resilience/guide.cfm>

Or google “NIST Resilience Planning Guide”

General E-mail: resilience@nist.gov



Questions?

